Chapter 1
Introduction

1-1. Purpose

This manual establishes criteria and provides guidance for the investigations preceding test quarries, for the development of test quarries, and for the planning and conduct of compacted test-fill programs at civil works projects.

1-2. Applicability

The provisions of this manual are applicable to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having civil works responsibilities.

1-3. References

Appendix A contains a list of required and related publications pertaining to this manual. Unless otherwise noted, all references are available on interlibrary loan from the Research Library, ATTN: CEWES-IM-MI-R, U.S. Army Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199.

1-4. Scope

This manual is intended to be a guide for use in planning the portions of the project geotechnical investigations dealing with rock source materials, the design and operation of a test quarry, and the design and conduct of a rock test fill program. This manual is not intended to be a textbook on engineering geology, blasting or rock excavation, or the many possible variations and elements of a test fill program. Actual investigations, test quarry design and development, and test-fill specifics must, in all instances, be tailored to individual project requirements. While the focus of the manual is upon determining the means to produce, place, and compact rock fill materials, the portions concerning test quarries are also applicable to establishing sources for other rock uses such as riprap or concrete aggregate. Part 1 of the manual will address test quarries and Part 2 will treat compacted rock test fills.

1-5. General Considerations

An integral part of the development of large civil works projects is the establishment of sources of material for embankment or fill construction. Many water-retention and water-conveyance projects require large volumes of rock material. As a consequence, the selection of the project site and the selection of the types of project components frequently involve the type and availability of soil and rock materials. Test quarries are especially important where there are questions about the suitability and behavior of rock in required excavations for use in embankment rockfill zones, for slope protection or (less frequently) for concrete aggregate sources. Even experienced practitioners often cannot predict how rock obtained from an excavation or quarry will break down upon blasting and excavation or subsequently upon transport, placement, and compaction in a fill operation. The most frequent trouble has occurred when the quarried material either contained more fines or more oversized material or degraded more in transport, placement, and compaction than had been anticipated in the design. It has sometimes been necessary to make major design changes because rock behavior was contrary to that anticipated by the designers (EM 1110-2-1911). The use of test quarries and associated test fills has assisted in precluding such expensive surprises. In addition to providing the rock materials for test fills, test quarries have also provided the following information for project design:

a. Cut slope design constraints resulting from geologic structural details.

b. Blasting patterns and loading and resulting rock fragmentation.

c. Suitability of quarry-run rock.

d. Required rock processing methods.

On many projects, the results of quarry tests have also aided prospective bidders with a much better understanding of required excavation methods and rock drilling and blasting characteristics. The slope development aspects of the test quarry development (presplitting panels and production blast stand-off distances) and geologic maps of the test quarry slopes have aided in the design of required excavation slopes. Because of the time and cost associated with rock test quarries and test fills, it is imperative that they be carefully designed and conducted to yield good, useful data for the design.

1-6. Test Quarry Justification

A test quarry is not justified under all circumstances. Before recommending that a test quarry program be initiated, certain questions should be carefully considered to determine if a test quarry can improve design, reduce the probability of differing site conditions claims and save money during construction. If most of the following

questions are answered in the affirmative, a test quarry program is probably justified.

a. Is the quantity of stone required for construction enough to merit the cost of developing a test quarry?

b. Are the project design and rock types to be exploited so unique that the necessary stone product information is not available from other projects?

c. Are there questions with regard to the project being considered which are peculiar to that project and can only be answered with a test quarry?

d. Is a rock test fill required which can only be constructed with rock obtained from a test quarry?

e. Are there reasons to suspect the durability and/or handling characteristics of the rock product which make it important to evaluate with a test quarry?